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Canadian Patents Database

(12) **Patent:** (11) **CA 645541**

(54) COIL LIFTING AND POSITIONING MECHANISM

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ABSTRACT:

CLAIMS: Show all claims

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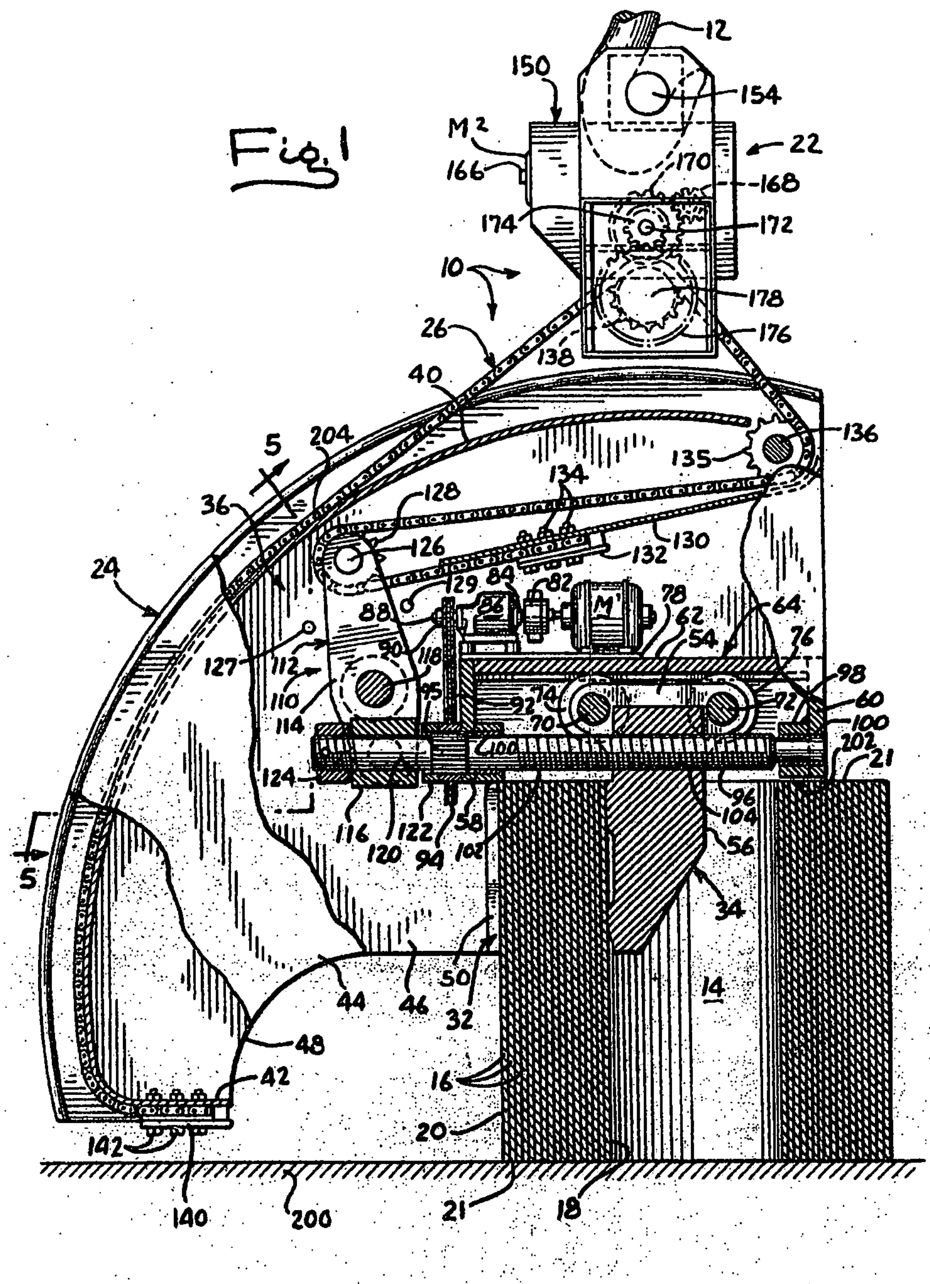

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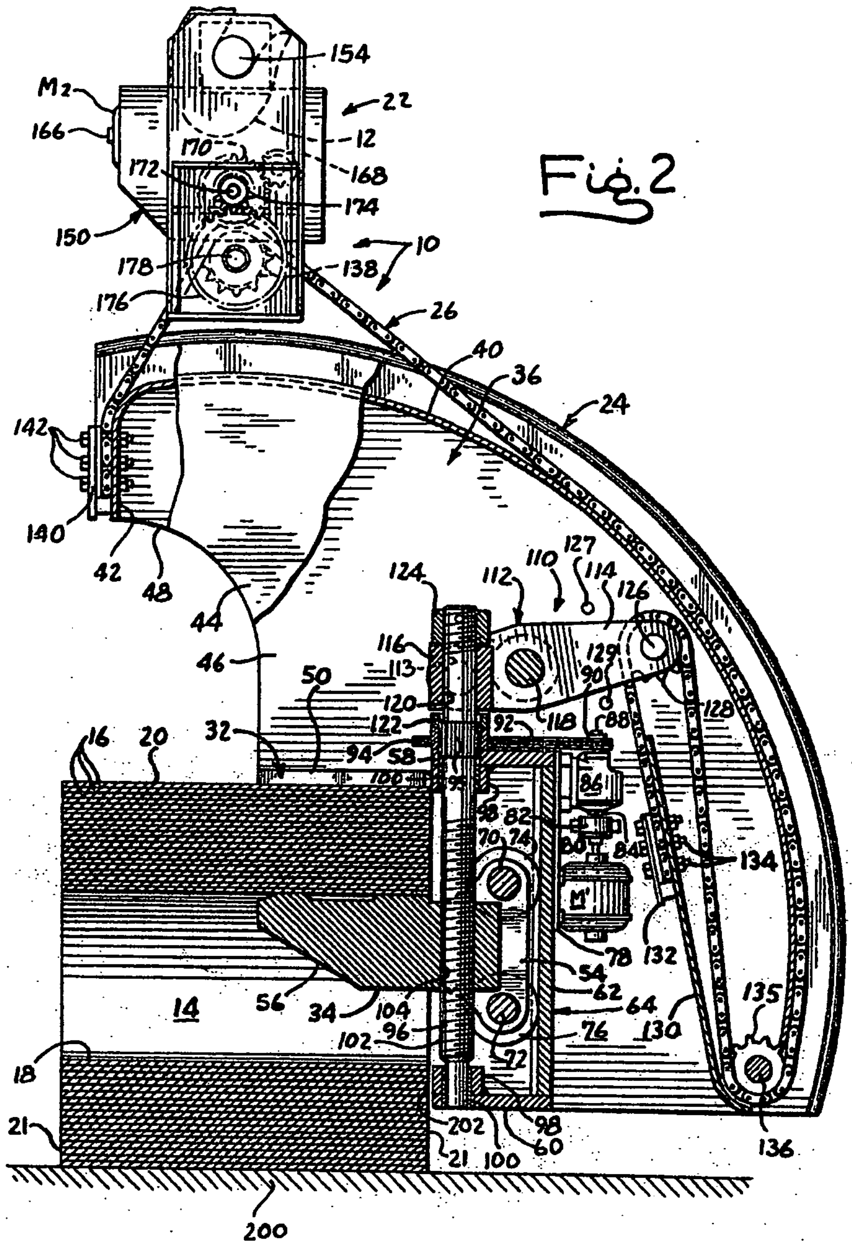

Fig. 2

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Fig. 3

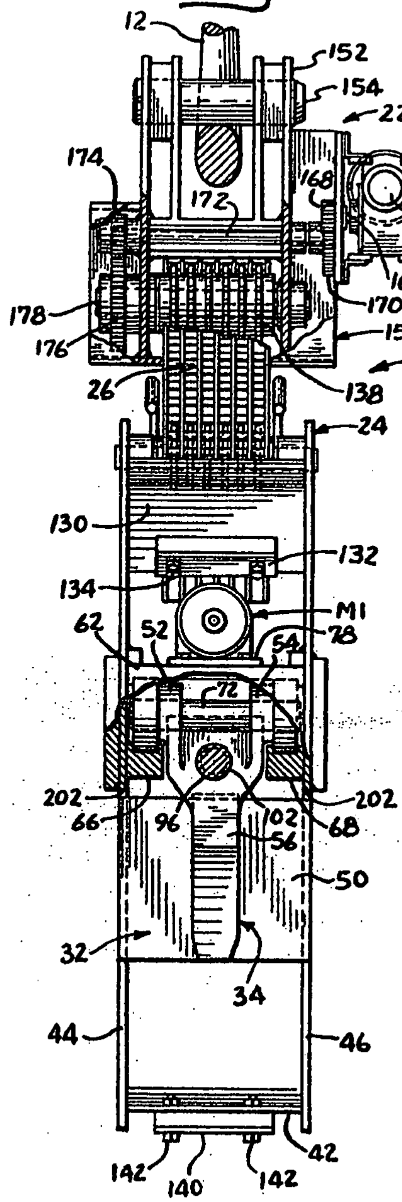


Fig. 4

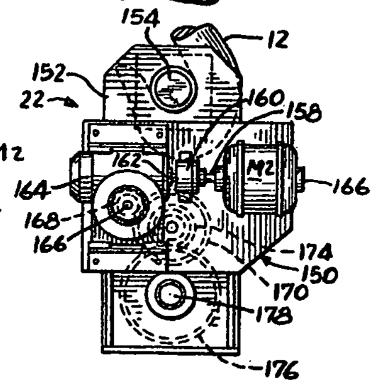
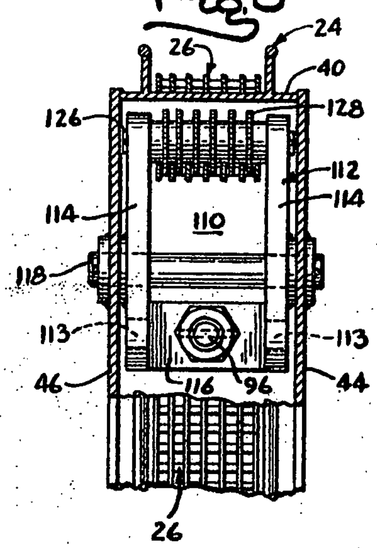


Fig. 5



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The improved lifting and positioning mechanism comprising the present invention has been designed for use primarily in connection with the lifting and transportation of sheet metal stock in coil form. Coils of the type with which the lifter mechanism of the present invention is concerned consist of elongated strips or sheets of sheet metal stock wound in convolute fashion to produce a series of continuous laminations, and produce in the final shape thereof, generally tubular integral laminated spool-like structures, the innermost convolutions of which define central bores through the spools.

The handling of sheet metal coils of the character set forth above, either at the steel mill for loading purposes, or at a consumer location where the coils are distributed throughout the plant for unwinding at punch presses, for example, presents a problem due to the relatively great mass and weight of these coils, as well as due to the fact that their cylindrical shape makes them awkward to handle. It is sometimes necessary to pick up such a coil when the same is supported with its longitudinal axis extending vertically, transport it to a different location and place it on a supporting surface with its axis extending horizontally. At other times, conversely, it is necessary to engage the coil when the same is in a horizontal position, transport it to a different location and deposit it in a vertical position. Present day lifter mechanisms have been provided with accessory devices which will enable them to handle coils of this general character for transportation from one place to another, but invariably it is necessary that the coils be initially received or engaged by the lifter mechanism when they are supported either in a horizontal position or a vertical position, and no provision is made for releasing the coils in any other position than the one in which they are received. Present

day coil lifting devices are generally of the character shown and described in Hooker et al United States Patent No. 2,841,434, granted on July 1, 1958 and entitled "AUXILIARY COIL LIFTING DEVICES FOR THE JAWS OF A SHEET LIFTER."

The present invention is designed to overcome the above-noted limitation that is attendant upon the use of conventional coil lifters of the type shown in the above-mentioned patent to Hooker et al, and toward this end, it contemplates the provision of a novel lifter construction whereby the lifter may initially receive the coil in practically any position of orientation, whether the coil be disposed with its axis extending horizontally, with its axis extending vertically, or whether the coil be positioned at some intermediate angle, and which lifter, further, is capable of depositing the coil in any desired position, whether horizontal, vertical, or otherwise. The principal object of the invention, therefore, is to provide such a coil lifter.

It is a further object of the invention, in a lifter of this general character, to provide a novel mechanism which is so designed that it may receive the coil in one given position and deposit the coil in a different position with the transition between the two coil positions taking place by an angular movement of the coil about an axis which is coincident with or not appreciably removed from the center of mass of the coil so that a minimum amount of torque need be applied to the coil and to the coil-supporting structure which moves therewith as the coil is being turned.

An additional and important object of the invention, in a positioning lifter of this character, is to provide a novel form of coil-engaging clamping jaw mechanism including a pair of cooperating clamping jaws adapted to engage a portion of a coil

to be lifted therebetween, together with means whereby the clamping jaws may be initially brought into preliminary clamping engagement with the coil, and thereafter, when lifting force is applied to the lifter mechanism bodily as a whole, an additional and materially increased degree of clamping force is automatically applied to the clamping jaws, the amount of force so applied being proportional to the weight of the coil undergoing lifting so that the heavier the coil, the greater will be the degree of clamping force applied thereto.

The provision of a coil lifting device which is relatively simple in its construction, one which is comprised of a minimum number of parts, particularly moving parts, and which, therefore, is unlikely to get out of order; one which is rugged and durable and which, therefore, will withstand rough usage; one in which the operative moving parts thereof are readily accessible for purposes of inspection, replacement of parts, or repair; one which is relatively small and compact in its design and consumes but little space; one which is capable of ease of assembly or disassembly for purposes of servicing; and one which otherwise is well-adapted to perform the services required of it, are further desirable features which have been borne in mind in the production and development of the present invention.

With these and other objects in view, which will become more readily apparent as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of parts shown in the accompanying three sheets of drawings forming a part of this specification.

In these drawings:

Fig. 1 is a sectional view taken substantially centrally and vertically through a coil lifting and positioning mechanism constructed in accordance with the principles of the present

invention and showing the same operatively applied to a coil which is disposed in a vertical position, the lifter being shown in the condition which it assumes immediately prior to the coil elevating operation;

Fig. 2 is a sectional view similar to Fig. 1 with the coil lifter being shown in the condition which it assumes after the coil has been turned through an angle of 90° and immediately prior to release of the coil;

Fig. 3 is an end view, partly in section of the structure shown in Fig. 1;

Fig. 4 is a fragmentary end view of a traction hoist assembly employed in connection with the present invention; and

Fig. 5 is a sectional view taken substantially along the line 5--5 of Fig. 1.

GENERAL CONSIDERATIONS

Referring now to the drawings in detail, and in particular to Fig. 1, a lifter constructed in accordance with the principles of the present invention has been designated in its entirety at 10. The lifter disclosed herein constitutes a preferred form or embodiment of the invention. It is adapted to be attached to and used in connection with the crane of an overhead hoist, the lifting hook of such hoist being designated at 12. The lifter constitutes a medium or instrumentality for handling laminated sheet metal coils such as the coil 14 in moving the coils from one location to another, and in so moving them, if desired, altering their position in space with respect to a horizontal plane.

The coil 14 is of conventional design and consists of a single unitary elongated strip of sheet metal which has been wound in convolute fashion on a mandrel to produce a series of adjacent convolutions 16 of the sheet material, and the mandrel

subsequently withdrawn so that a spool-like article having a central bore 18 extending therethrough and presenting a substantially cylindrical outer surface 20 and substantially flat annular end faces 21 is produced. The lifter 10 has been designed primarily for transporting such coils from one location to another with the lifter receiving a coil in a vertical position, i.e., in a position wherein one of the annular end faces 21 rests squarely on a supporting surface, and for depositing the coil either in the same position or in a horizontal position wherein the cylindrical surface 20 thereof is placed tangentially on a supporting surface at the time the coil is released. Alternatively, the lifter 10 has been designed so that it may receive the coil in a horizontal position, transport it, and thereafter, release the same in a vertical position. It is within the scope of the present invention, however, that the lifter 10 may be employed for receiving a coil in any intermediate position as between the vertical position wherein it is illustrated in Fig. 1 and the hotizontal position wherein it is illustrated in Fig. 2 and for discharging the coil in the same or any other intermediate position.

BRIEF DESCRIPTION

The lifter 10 is comprised of three main or principal parts or assemblies, including a self-contained motor-driven assembly designated in its entirety at 22 and hereinafter referred to as the traction hoist; a tiltable assembly designated in its entirety at 24 and hereinafter referred to as the tiltable lifter proper and an interconnecting flexible medium in the form of a conventional compound roller chain assembly 26 by means of which the tiltable lifter proper 24 is suspended from the traction hoist assembly 22 for swinging movements about a horizontal axis in a manner that will be made clear presently. The tiltable lifter proper includes

a pair of cooperating lifter jaws 32 and 34, respectively, the jaw 32 being fixed relative to the frame structure 36 and the jaw 34 being movable toward and away from the jaw 32 for coil-clamping and coil-releasing purposes, respectively. As shown in Figs. 1 and 2, the jaw 32, which will hereinafter be referred to as the fixed jaw, is adapted to engage the outside cylindrical surface 20 of the coil 14, while the jaw 34, which is hereinafter referred to as the movable jaw, is adapted to engage the inside cylindrical surface of the bore 18 so that one side of the tubular coil 14 may be compressed and thus clamped between the two jaws 32 and 34 for coil-lifting and coil-orienting purposes, as will also be described presently.

THE LIFTER ASSEMBLY PROPER

The Lifter Casing

The lifter assembly proper 24 includes the previously mentioned casing or framework 36. This casing may be formed of flat, relatively thick, steel plate stock and includes an arcuate outer wall structure 40 which is preferably in the form of a cylinder fragment and which is approximately of 90° in extent. In the position in which the casing 36 is shown in Fig. 1, the lower end of the wall 40 is inturned as at 42. The casing 36 is further provided with vertical side walls 44 and 46, respectively, which are marginally joined to the arcuate wall 40 and to the inturned end 42 of the latter. The lower edges of the side walls 44 and 46 are relieved or cut away as at 48 for clearance purposes, as will be explained subsequently.

The Clamping Jaw Structure

The clamping jaw structure includes the previously mentioned fixed and movable jaws 32 and 34, respectively, the former jaw being in the form of a curved plate 50 secured to and bridging the distance between the two side walls 44 and 46. The movable jaw 34

is of yoke-like design (see also Fig. 3) and is in the form of a casting including yoke sides 52 and 54 which merge with the depending jaw proper 56. A pair of vertically disposed plates 58 and 60 extend between the side walls 44 and 46, are disposed in parallelism and are bridged by a horizontal plate 62 which also extends between the side walls, the three plates 58, 60 and 62, in combination with portions of the side walls 44 and 46 defining an open-ended box-like structure or cage which has been designated in its entirety at 64 and within which cage there is confined tractional supporting means for the movable jaw structure 34 as a whole.

The tractional supporting means for the movable jaw structure 34 comprises a pair of track rails 66 and 68 (Fig. 3) welded or otherwise secured to the side plates or walls 44 and 46, respectively. A pair of spaced shafts 70 and 72 extend between the yoke plates 52 and 54 transversely of the casing 36 and carry pairs of wheels 74 and 76, respectively, one wheel of each pair being adapted to ride on the track 66 while the other wheel is adapted to ride on the track 68. The two parallel tracks 66 and 68 extend in a direction normal to the operative vertical face of the jaw plate 50 so that the movable jaw 34 is constrained to travel in a horizontal linear path toward and away from the jaw 32.

The Jaw Moving Instrumentalities

The movable jaw 34 is adapted to be power-driven, which is to say that its movements toward and away from the jaw 32 are effected under the control of a reversible electric motor M1. The motor M1 is operatively mounted on a base plate 78 carried on the upper face of the horizontal plate 62. The output shaft 80 of the motor M1 is operatively connected through a torque limiting clutch assembly 82 to the input shaft 84 of a gear

reduction device <u>86</u> also mounted on the base plate 78. The output shaft <u>88</u> of the gear reduction device carries a sprocket wheel <u>90</u> which is operatively connected by a chain <u>92</u> to a second sprocket wheel <u>94</u> slidably splined as at <u>95</u> on a shaft or feed screw <u>96</u> which extends longitudinally of the casing 36 and which is rotatably journalled in the plates 58 and 60 by means of bearing sleeves <u>100</u>.

The feed screw 96 projects completely through the plate 58 and the sprocket wheel 94 is disposed on the feed screw 96 in a position closely adjacent to the plate 56. The medial regions of the feed screw 96 are threaded as at <u>102</u> and the threaded portion of the shaft projects through and is threadedly received in a threaded bore <u>104</u> which is formed in the upper region of the movable jaw proper 56.

The motor M1 is preferably of the series wound direct current reversible type and it will be seen that energization of the motor in such a manner as to cause rotation of the motor shaft 80 in one direction or the other will render operative the train of driving mechanism extending from the shaft 80 to the shaft 96 and including the torque limiting clutch assembly 82, the gear reduction device 84, and the chain and sprocket mechanism 90, 92, 94. Upon rotation of the motor M1 in one direction, the movable jaw assembly 34 will travel along the tracks or rails 66, 68 in a direction extending away from the fixed jaw 32, while upon rotation of the motor shaft 80 in the opposite direction the movable jaw 34 will close upon the fixed jaw 32. As will become more clear presently, when the description of the operation of the present lifter construction is set forth, the motor M1 is employed for initially advancing the movable jaw 34 toward the fixed jaw 32 to grip the cylindrical wall of the coil assembly 14 therebetween, as previously described. Means are provided whereby

after such initial gripping action of the jaw section 32 and 34, upon lifting of the coil from the surface on which it is supported, a further clamping action of the jaw will be effected under the influence of the combined weight of the lifter proper 24 and of the coil supported thereby. Accordingly, the shaft 96 is not only rotatable in the bearings 100, but it is capable of limited axial sliding movement in these bearings. Sliding movement of the shaft 96 in a direction to enhance the clamping action of the jaws 32 and 34, i.e., movement of the shaft to the left as viewed in Fig. 1, is effected under the control of an auxiliary jaw clamping mechanism designated in its entirety at 110, which is operatively connected to the chain assembly 26 and which becomes effective when the lifter proper 24 is freely suspended by means of the chain assembly 26 from the traction hoist assembly 22.

The Auxiliary Jaw Clamping Mechanism

The auxiliary clamping mechanism 110 is best seen in Figs. 1, 2 and 4, and comprises a combined lever and tension-applying shifting fork assembly 112 including a pair of parallel side arms 114 pivotally connected as at 113 at their lower ends by a cross member 116. The arms 114 are pivotally mounted within the casing structure 36 between the side wall 44 and 46 thereof on a transversely extending rod 118 the ends of which are carried in the side walls. The projecting end of the shaft 96 extends through a bore 120 provided in the member 116 and this latter member is confined between a fixed crossbar 122 through which the screw 96 passes and a nut 124 which is threadedly received on the free end of the shaft 96. The upper end of the fork assembly 112 carries a transverse shaft 126 on which there is mounted a sprocket wheel or pulley 128 around which a portion of the chain assembly 26 is adapted to pass, the chain assembly being so disposed that when tension is applied

thereto for lifting purposes in a manner that will be described subsequently, the upper end of the fork assembly 12 will be forcibly drawn to the right as viewed in Fig. 1 so as to normally urge the fork assembly 112 to rotate about the axis of the shaft 118 in a clockwise direction to, in turn, cause the lower end of the fork assembly 112 to move to the left, thus causing the cross member 116 to bear against the nut 124 and draw the rod 96 to the left to urge the movable jaw member 34 into firm engagement with the inside surface of the bore of the sheet metal coil 14. The limit of swinging movement of the fork assembly 112 in opposite directions may be determined by a pair of spaced strip pins 127 and 129 on opposite sides of the assembly.

THE SUPPORTING CHAIN

The supporting chain 26 is, in itself, of conventional design and consists of an assembled series of alternate roller links and pin links and in which the pins are free to pivot within the bushings of the roller links with minimum clearance, thus permitting free articulation and lubrication. As best seen in Figs. 3 and 5, the roller chain 26 is of multiple link width. One end of this chain is firmly clamped against the underneath side of an inclined plate 130 which extends between the side plates 44 and 46. The clamping means for this end of the chain consists of a clamping plate 132 which is firmly clamped against the end of the chain by means of a series of nut and bolt assemblies 134 which extend through the two plates 130 and 132 and pass through various roller chain openings so that when the assemblies 134 are tightened, the end of the chain is firmly clamped between the two plates. The chain 26 passes around the pulley 128 and from thence it extends around a second pulley 135 carried on a shaft 136 extending between the side plates 44 and 46. From the pulley 135 the chain extends over a driving sprocket 138 associated with the traction hoist 22

and from this latter sprocket the chain extends forwardly around the curved outer face of the casing wall 40 and along the inturned end 42 where the other end of the chain is clamped by means of the clamping plate 140 and the nut and bolt assembly 142, the clamping assembly 140 and 142 being similar to the clamping assembly 132, 134 previously described. The length of the chain 26 is such that, in its free state, a certain amount of slack will exist in the chain throughout the tortuous path which it follows and which has been described above. The chain 26 constitutes the sole suspension means whereby the lifter assembly proper 24 is supported from the traction hoist 22 and when the traction hoist 22, during any given lifting operation, is initially raised for coil transporting purposes, the slack in the chain 26 is taken up in the manner indicated in Figs. 1 and 2 so that the chain becomes taut around the various pulleys 128, 135 and 138 and against the outside face of the curved wall 40, thus exerting a considerable degree of pulling force on the upper end of the fork assembly 112, as indicated by the arrows in Figs. 1 and 2, so that a powerful clamping action will obtain between the two jaws 32 and 34 in a manner that will be described presently.

THE TRACTION HOIST ASSEMBLY

The traction hoist 22 involves in its general organization, a casing structure 150 of open-ended, inverted, box-like design and including a pair of vertical extensions 152 (Fig. 3) across which there extends horizontally a lift pin 154 designed for cooperation with the lifting hook 12 of the crane structure. The casing or framework 150 includes a pair of supporting brackets 156 for an electric motor M2 having a motor shaft 158 operatively connected through a slip clutch mechanism 160 similar to the previously described mechanism 82, to the input shaft 162 of a conventional worm gear reduction mechanism 164 having an output

shaft 166. The output shaft 166 carries a pinion 168 meshing with a large gear 170 mounted on a shaft 172 journalled in the casing 150. The shaft 172 carries a small gear 174 which meshes with a large gear 176 carried on a drive shaft 178 journalled in the casing 150, and on which drive shaft the previously mentioned traction drive sprocket 138 is mounted. From the above description and from the design of the various elements of the power train illustrated herein, it will be seen that a very appreciable gear reduction will take place between the motor shaft 166 and the drive shaft 178.

OPERATION

In the operation of the coil lifting and positioning mechanism 10, assuming that a coil 14, resting on a supporting surface 200 as shown on Fig. 1 with the longitudinal axis thereof extending vertically, is to be picked up or lifted and transported to another location and desposited on the supporting surface as indicated in Fig. 2 with its axis extending horizontally, the crane is operated to bring the mechanism 10 into vertical register with the coil 14 with the open jaws 32, 34 substantially vertically aligned with a region of the cylindrical wall of the coil. The lifting hook 12 is lowered so that the jaws 32 and 34 may straddle the coil wall as illustrated in Fig. 1. Vertical register of the jaws 32, 34 with the coil wall for operative clamping purposes is made possible by initially operating the motor M2 in one direction or the other, as the case may be, to cause the traction driving sprocket 138 to move or slide the chain 26, so to speak, over the upper portions of the pulley until such time as the lifter assembly proper 24 assumes the position wherein it is illustrated in Fig. 1, with the inturned end 42 of the wall 40 extending horizontally and with the bisecting plane of the jaws 32 and 34 extending vertically. The motor M1 is operated in such a manner as to rotate the feed

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screw 96 in a direction which will move the movable jaw 34 away from the fixed jaw 32 and the motor M1 is maintained energized until such time as a sufficient clearance is attained between the two jaws to accommodate the thickness of the coil wall. Upon lowering of the assembly 24 over the coil, the upper end of the coil will abut against a horizontal edge portion 202 of each side wall 44 and 46, thus limiting the downward extent of movement of the assembly 24. Thereafter, the motor M1 is operated in a direction to cause the movable jaw 34 to move toward the fixed jaw 32 until such time as the wall of the coil 14 is firmly clamped between the two jaws. At this time, the torque limiting or slip clutch 82 will commence to slip, but, because of the relatively great extent of gear reduction effected through the train of gearing extending between the motor shaft 80 and drive shaft 178 and the self-locking screw 96, a self-locking action will take place wherein the wall of the coil 14 is firmly clamped between the two jaws.

Although in the broadest aspect of the present invention, it is contemplated that the initial motor-derived compressional forces of the two jaws 32 and 34 against the wall of the coil 14 may be sufficient to retain the coil in position between the jaws during lifting operations, in the illustrated embodiment of the invention, the auxiliary clamping mechanism 110 is relied upon principally to effect the necessary clamping action. Accordingly, as the crane is operated to raise the lifting hook 12 and, consequently, the traction hoist assembly 22, any slack which may exist in the chain 26 is taken up and a powerful tension is applied

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to the chain, the magnitude of this tension being a trigonometric function of the angles involved in the triangle existing between the centers of the shafts 136 and 178 and the point of tangency of the straight reach section of the chain where it engages the curved wall 40. This point of tangency is designated at 204 in Fig. 1. Since one end of the chain is anchored to the inturned portion 42 of the wall 40, the chain tension is applied around the pulley 128 where a block-and-pulley type mechanical advantage is obtained and an extremely powerful thrust in the direction indicated by the arrows in Fig. 1 is exerted upon the upper end of the fork assembly 112.

It is to be noted at this point that the axis of the shaft 118 is disposed at a region well below the medial transverse axis of the fork assembly 112 as a whole so that the fork assembly operates in the manner of a lever of the first class and the pull exerted on the upper end of the fork assembly is translated through the cross member 116 to the feed screw 96 and a powerful pull is exerted upon the feed screw tending to move the movable jaw 34 toward the fixed jaw 32 and firmly clamp the coil wall between the two jaws.

After the coil wall has been thus firmly clamped between the two jaws 32 and 34, and the coil elevated from the supporting surface 200, a sufficient distance to afford the necessary clearance, the motor M2 is operated in such a manner as to cause the traction pinion 138 to rotate in a clockwise direction as viewed in Fig. 1, whereupon the driving sprocket will tend to run beneath the chain, so to speak, to the left as viewed in Fig. 1. Inasmuch as the traction hoist 22 is supported on the hook 12 and thus exerts a reaction force on the chain 26, the latter will be slid to the right as viewed in Fig. 1, and in so sliding, the chain 26 will unwind, so to speak, from the curved surface of the wall 40 and the entire

assembly 24 will be rotated bodily in a clockwise direction as viewed in Fig. 1 until such time as the traction sprocket has reached a point on the chain near the end thereof which is anchored as at 140. In this position of the assembly 24, the inturned portion 42 of the wall 40 will extend substantially vertically and the axis of the coil 14 will extend substantially horizontally. After the hook 12 has been lowered to a sufficient degree to relieve the tension of the chain 26 through the auxiliary clamping mechanism 110, the motor M1 may be operated in a direction to rotate the feed screw 96 and cause the movable jaw 34 to be moved away from the fixed jaw 32 and thus release the coil wall. The crane may then be operated to shift the entire lifter assembly 10 to the right, as viewed in Fig. 2, whereupon the jaws will move out of register with the coil 14 and the coil will remain supported on the surface 202 in its horizontal position.

It is obvious that in order to pick up and transport a coil 14 which initially assumes a horizontal position on the supporting surface 202 and to deposit the coil in a vertical position at another location on the supporting surface 202, a reversal of the operations described above may be resorted to. To avoid needless repetition of description, these operations will not be detailed herein. It is also obvious that the lifter mechanism 10 of the present invention may be employed for receiving coils which are disposed in any intermediate position as between the vertical position illustrated in Fig. 1 and the horizontal position illustrated in Fig. 2 and depositing them in the same or a different intermediate position.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit of the invention.

For example, as previously described, it is within the purview of the present invention to omit the auxiliary clamping mechanism 110 by fastening the ends of the chain 26 to fixed points on the casing or framework 36. The use of the torque limiting clutches 82 and 160 in combination with self-locking gearing may be desirable in some instances, while in other instances, it may be found expedient to omit these clutches and employ limit switches at appropriate points for terminating the operation of the motors M1 and M2, either by deenergizing the same or by utilizing suitable brake devices. Additionally, while the flexible supporting medium which extends between the traction hoist assembly 22 and the lifter assembly proper 24 have been shown as being in the form of a roller chain which passes over a drive sprocket, it is contemplated that a flexible belt, chain or the like passing over a drive pulley may be employed, if desired. Therefore, the specific form of the improved lifter mechanism illustrated herein does not by any means indicate the only form contemplated, the illustrated form being merely one form which has been developed for commercial adaptation of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated flexible linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having one end region fixed to said frame and having its other end region operatively connected to said feed screw, the intermediate reach of said flexible member being normally slack, guide means for said intermeddate reach whereby, upon application of upward lifting force to said intermediate reach at various points therealong, the flexible member will be drawn taut and a degree of tensioning pull will be applied to said feed screw in a direction tending to move the movable jaw toward said fixed jaw, said traction hoist assembly including a traction drive wheel underlying said intermediate reach and over which the flexible member is adapted to pass in opposite

directions upon rotation of the traction wheel in opposite directions respectively, and a reversible electric motor operatively connected to said traction drive wheel in driving relationship.

2. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated flexible linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having one end region fixed to said frame and having its other end region operatively connected to said feed screw, the intermediate region of said flexible member being normally slack, said frame being formed with an arcuate drum surface for the intermediate reach of said flexible member, guide means including said drum surface for said intermediate reach of the flexible member whereby, upon application of upward lifting force to said intermediate reach of the flexible member, the latter will be drawn taut against said drum surface and a degree of tensioning pull will

be applied to said feed screw in a direction tending to move the movable jaw toward said fixed jaw, said traction hoist assembly including a traction drive wheel underlying said intermediate reach of the flexible member and over which the latter passes, and a reversible electric motor operatively connected to the traction drive wheel.

3. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated flexible linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having one end region fixed to said frame, a lever pivoted medially of its ends to said frame and having one end thereof connected to said feed screw, the other end of said lever being connected to the other end region of said flexible member, the intermediate reach of said flexible member being normally slack, guide means for said intermediate reach

whereby, upon application of upward lifting force to said intermediate reach at various points therealong, the flexible member will be drawn taut and a degree of tensioning pull will be applied to said feed screw in a direction tending to move the movable jaw toward said fixed jaw, said traction hoist assembly including a traction drive wheel underlying said intermediate reach and over which the flexible member is adapted to pass in opposite directions respectively, and a reversible electric motor operatively connected to said traction drive wheel.

4. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated flexible linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having its opposite ends fixed to said frame, a shifting fork pivoted to said frame and operatively embracing said feed screw, a pulley on said shifting fork, said flexible member passing around said pulley, the intermediate reach of said flexible member being normally slack, guide means for said intermediate reach whereby, upon application of upward lifting force to said intermediate reach at various points therealong, the flexible member will be drawn taut and a degree of tensioning pull will be applied to said feed screw through the medium of said pulley in a direction tending to move the movable jaw toward said fixed jaw, said traction hoist assembly including a traction drive wheel underlying said intermediate reach and over which the flexible member is adapted to pass in opposite directions respectively, and a reversible electric motor operatively connected to said traction drive wheel.

5. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated flexible linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible electric motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having one end fixedly connected to said frame adjacent one end thereof, a pulley mounted on said frame adjacent the other end of the frame, a shifting fork pivoted to the frame and operatively embracing said feed screw, a pulley on said shifting fork, the other end of the flexible member being fixedly connected to the frame adjacent said other end of the latter, the intermediate reach of said flexible member being normally slack and passing around said pulley on the frame in one direction and around said pulley on the shifting fork in the other direction, said traction hoist assembly including a traction drive wheel underlying the intermediate reach of the flexible member between the pulley on the frame and said one end of the flexible member, and a reversible electric motor operatively connected to said traction drive wheel.

6. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible electric motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having one end fixedly connected to said frame adjacent one end thereof, a pulley mounted on said frame adjacent the other end of the frame, a shifting fork pivoted to the frame and operatively embracing said feed screw, a pulley on said shifting fork, the other end of the flexible member being fixedly connected to the frame adjacent said other end of the latter, the intermediate reach of the flexible member being normally slack and passing around said pulley on the frame in one direction and around said pulley on the shifting fork in the other direction, the portion of the frame between said one end thereof and said pulley on the frame presenting an outwardly bowed drum surface, said traction hoist assembly including a traction drive wheel underlying the intermediate reach of the flexible member between the pulley on the frame and said one end of the

flexible member, and a reversible electric motor operatively connected to said traction drive wheel, said drum surface being adapted to have said intermediate reach of the flexible member progressively wrapped and unwrapped therearound during rotation of said drive wheel.

7. A lifter mechanism adapted to receive an article supported at one location on a supporting surface in one position of orientation and transport the article to another location and deposit the same on a supporting surface at said latter location in a different position of orientation, said lifter mechanism comprising in combination a lifter assembly proper, a traction hoist assembly, and an interconnecting elongated linear supporting member between said lifter assembly proper and said traction hoist assembly, said lifter assembly proper comprising a frame providing a fixed clamping jaw, a movable clamping jaw carried by said frame and movable toward and away from said fixed clamping jaw, a feed screw rotatably mounted on said frame and having a threaded connection with said movable clamping jaw, said feed screw also being capable of limited sliding movement axially in the direction of movement of the movable clamping jaw, a reversible electric motor mounted on said frame, means establishing a power train between said motor and feed screw, said flexible member having one end fixedly connected to said frame, adjacent one end of the frame and having its other end fixedly connected to the frame adjacent the other end of the frame, the intermediate reach of the flexible member including a block and tackle connection between said intermediate reach and the feed screw whereby, upon application of upward lifting force to said intermediate reach at various points therealong, the

flexible member will be drawn taut and a degree of tensioning pull will be applied to said feed screw through said block and tackle connection in a direction tending to move the movable jaw toward said fixed jaw, said traction hoist assembly including a traction drive wheel underlying said intermediate reach and over which the flexible member is adapted to pass in opposite directions upon rotation of the traction wheel in opposite directions respectively, and a reversible electric motor operatively connected to said traction drive wheel in driving relationship.

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